

# EICAC report

(Electron-Ion-Collider Advisory Committee)

## March 2014

# eRHIC findings

FFAG concept introduced into electron circulation arcs.

Critical accelerator R&D items include: high current (50 mA) polarized electron gun (Gatling gun); demonstration of high energy – high current ERL; polarized He-3 source R&D and acceleration; coherent electron cooling; compact loop magnets for FFAG; development of eRHIC-type SRF cavities at lower frequency; crab cavities; beam-beam simulations for EIC.

The ERL test facility is being considered as a test bed for a number of eRHIC demonstrations including integrating FFAG into the circulation arcs. This is being pursued with program development funds.

A prototype Gatling gun is under construction.

A potential micro-bunching Coherent Electron Cooling (CeC) concept has been suggested.

There is a first, high level cost estimate for eRHIC.

Considerable progress has been made on chromaticity control & IR design.

# Comments, recommendations

We commend ... the introduction of the NS-FFAG arcs .....

The above listed ... R&D efforts address more than 2 orders of magnitude [lumi] risk.

We believe that the design of the needed beam spreaders/combiners is in flux and remains challenging, particularly the impacts on synchronization and polarization.

We encourage the consideration of micro-bunching CeC.

The beam-beam disruption is stronger than in conventional colliders. Detailed study is needed to evaluate ... beam-beam limit ... in addition to the kink instability ...

The ERL synchrotron radiation will have a relatively high critical energy, potentially leading to activation issues.

The flexibility in parameter space to achieve needed performance appears limited, particularly if the ERL parameters fall short.

Confidence in the ERL design will rely in part on extrapolation from tests at low energy and small energy loss. Scaling up to the full ERL ... will require a thorough understanding of all the parameters affecting this scaling. We encourage BNL to articulate the issues and risks ... and present the needed tests to mitigate this risk.

We look forward to seeing the results of the 50mA gun test ...('14), the CeC PoP test ... ('15/16), & the prototype system test of ERL ... ('14-'16).